Title: Biomedical Research at Los Alamos National Laboratory

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Intended for: Community Outreach

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Biomedical Research at Los Alamos National Laboratory

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Background

- Originally from NY

- Attended the University of Delaware
  - Biology & Psychology double major
  - Master's of Arts in Teaching (+1 year)
- Taught high school AP Biology for 2 years
- Taught middle school Science for 1 year

- Went back to school for a second Master's Degree
  - Master's of Science in Biomedical Engineering

Background

- Currently live in Los Alamos, NM

- Research Technologist at Los Alamos National Laboratory (LANL)
  - Also did my Master's thesis work at LANL
  - Chemistry for Biomedical Applications Team
  - Focus on biosensors research

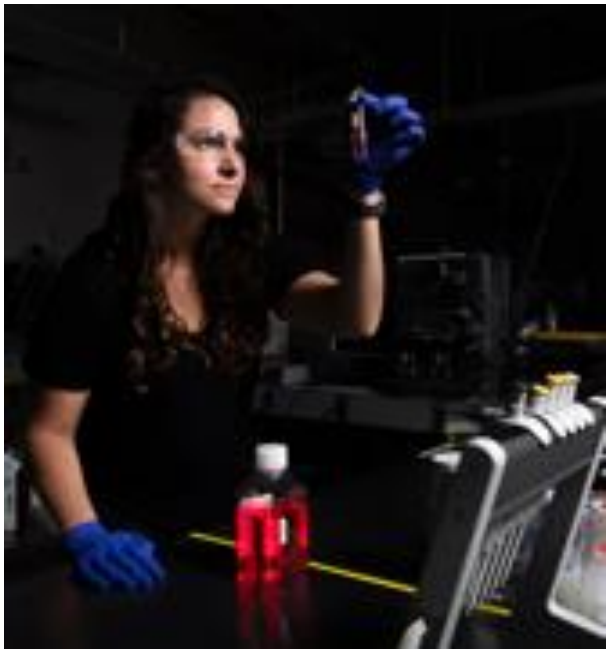
Los Alamos National Laboratory

- Department of Energy national laboratory
- Established in 1943 as part of the Manhattan Project
- Currently performs research in diverse fields
  - National security
  - Nuclear fusion
  - Energy
  - Space exploration
  - Medicine and Biology

Daily Tasks

- Lab Manager
  - Inventory
  - Scheduling equipment maintenance
  - Laboratory documentation (biosafety)
  - Scheduling and organizing team meetings

- Research Projects
  - Weekly meetings with teams to plan experiments
  - Long-term planning – how to accomplish goals of specific projects
  - Planning and executing experiments
  - Data analysis – which guides future experiments
  - Designing and building microfluidic devices

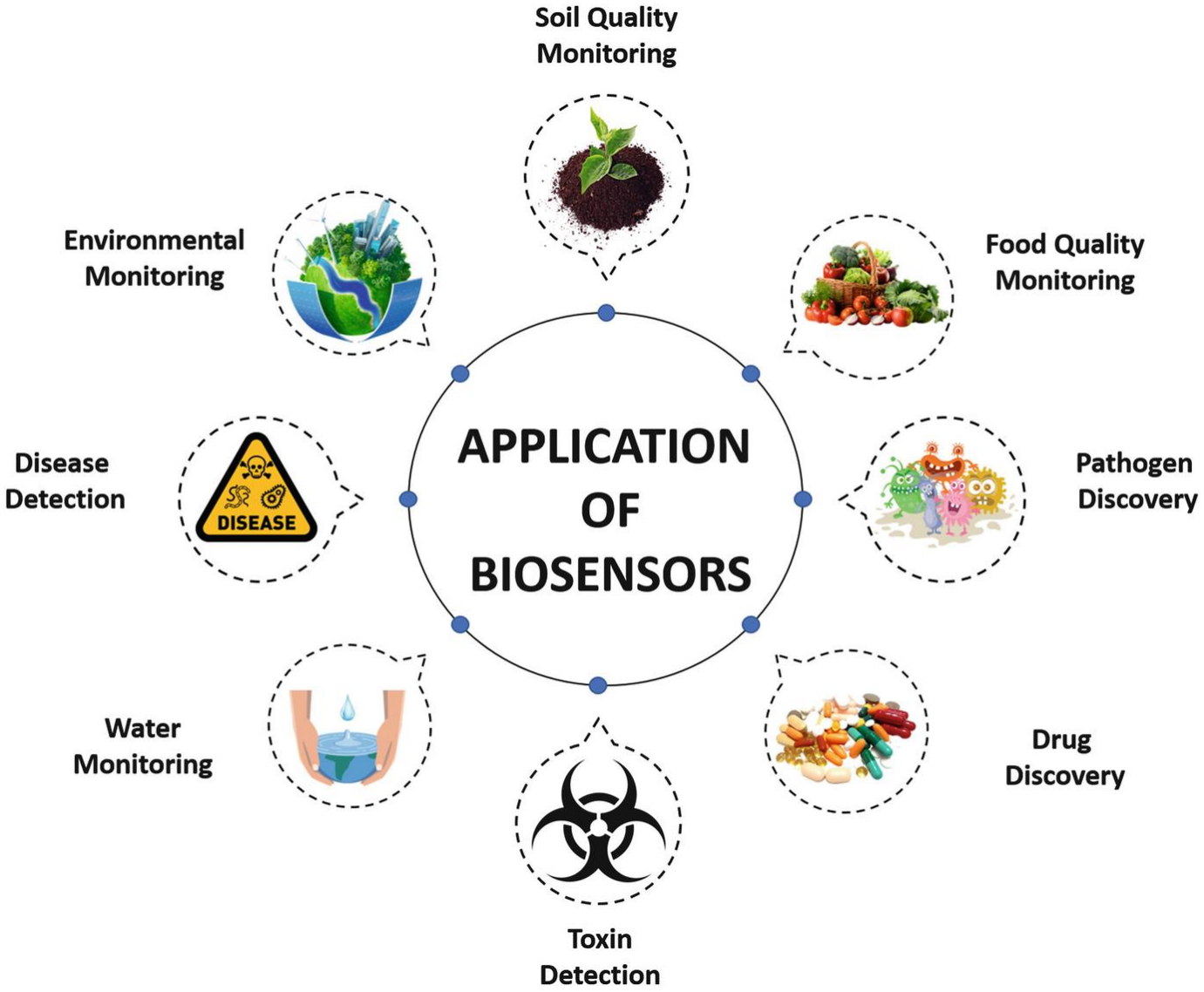


Major Research Areas

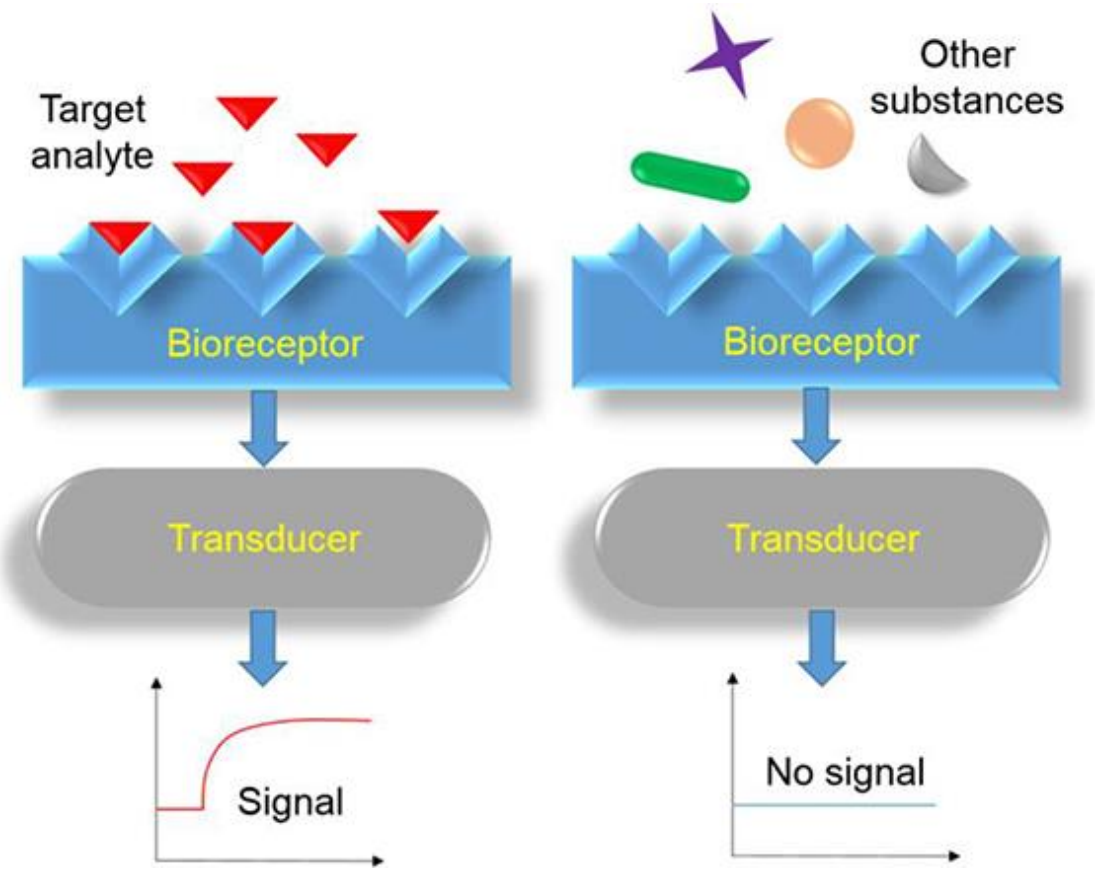
1. Biosensors

2. Microfluidics

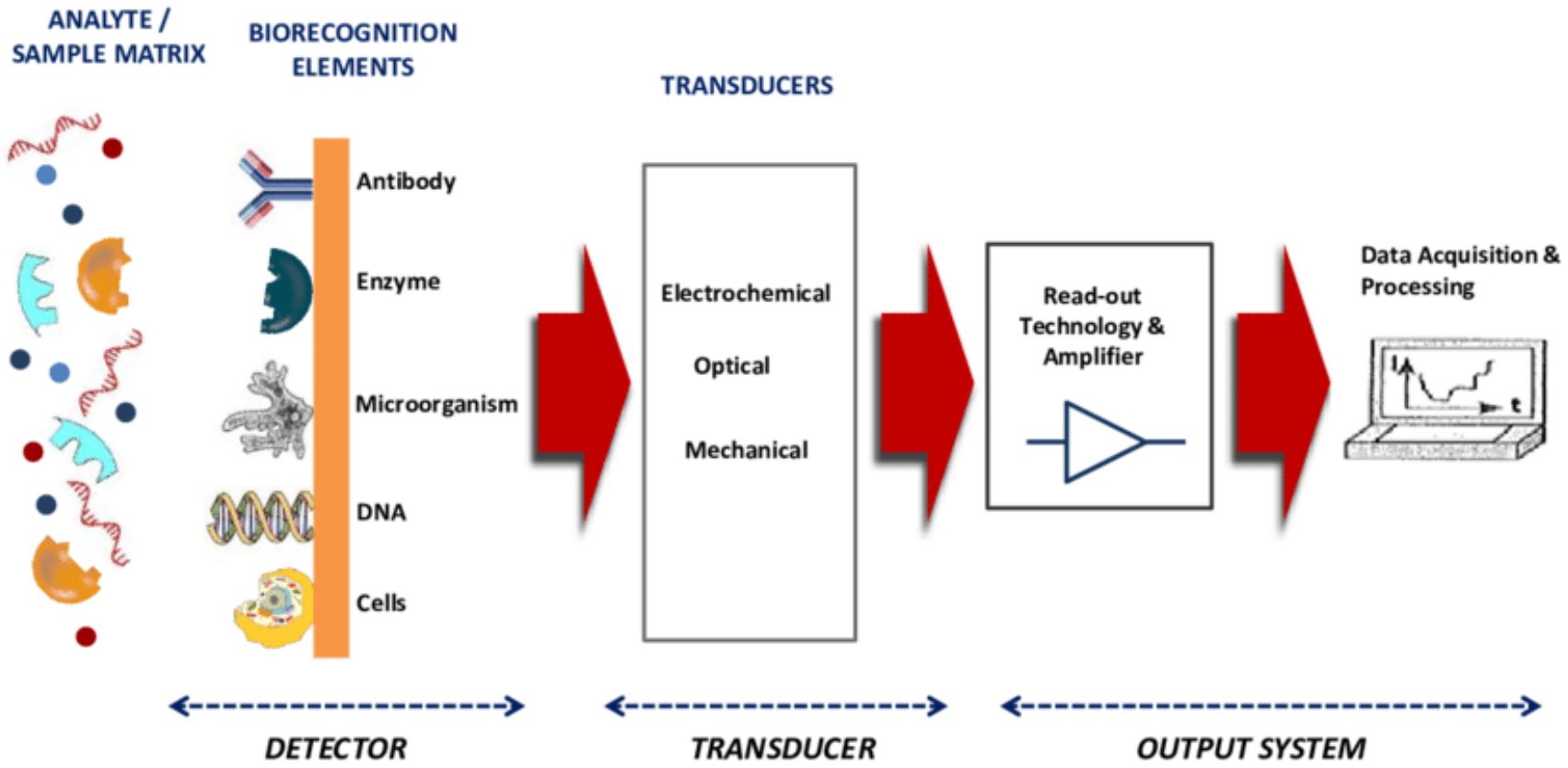
Biosensors


Soil Quality Monitoring
Environmental Monitoring
Food Quality Monitoring
APPLICATION OF BIOSENSORS
Disease Detection
DISEASE
Pathogen Discovery
Water Monitoring
Drug Discovery
Toxin Detection

Biosensors – how they work

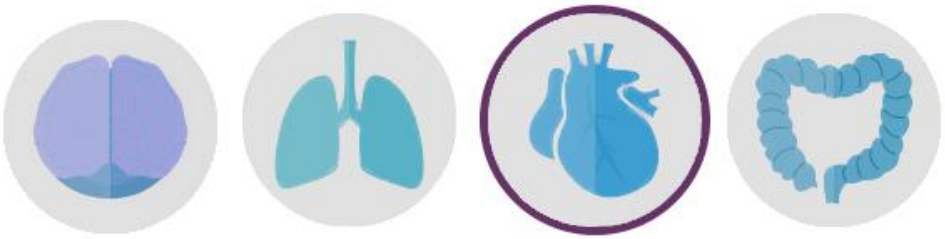


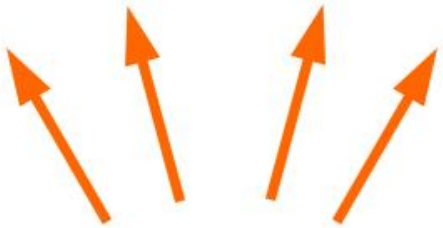
Biosensors – how they work

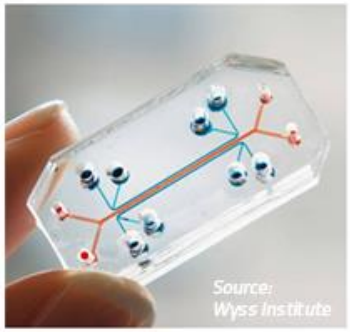


Microfluidics

- Commonly called “Lab on a Chip”
- Miniaturization of laboratory processes
  - Clinical pharmaceutical trials
  - Personalized medicine
  - Sample processing
  - Biosensors

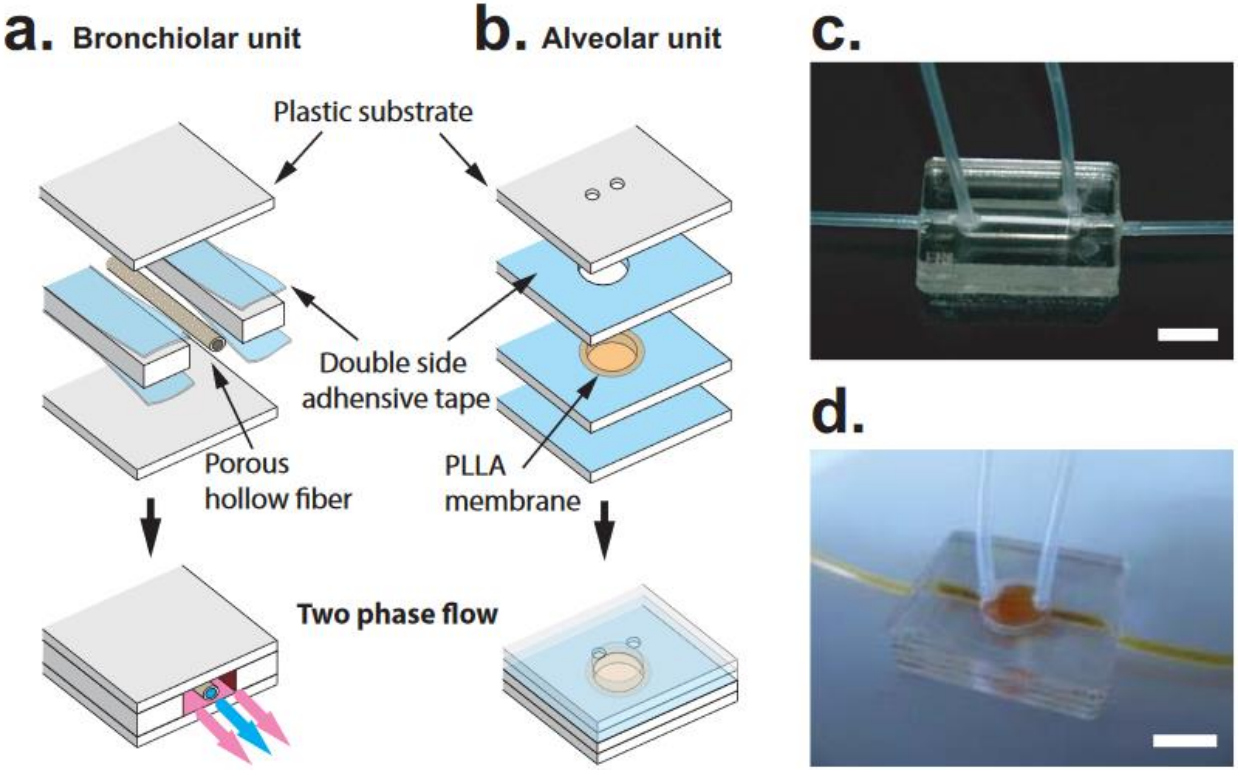






Microfluidics

- Involves:
  - Iterative design
  - Biological compatibility
  - Additive manufacturing
  - 3D printing
  - Imaging
  - More!



Example: “lung on a chip”

Our Biosensor

Universal Bacterial Sensor

Global Health

Biological Warfare

Deployed Troops

Biomarkers of Interest

- **Biomarker:** molecules that are useful indicators of disease state
  - Can be your own biomarkers
    - HDL & LDL (cholesterol)
  - Can be pathogenic biomarkers
    - Molecules secreted by bacteria, viruses, etc. upon infection
    - Detection can help to diagnose specific illnesses

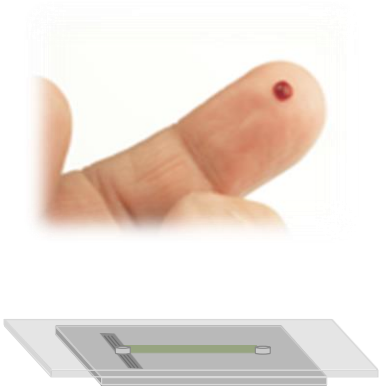
- Our sensor can detect:
  - Toxins
  - Bacterial biomarkers
  - DNA/RNA
  - Cholesterol
  - Cancer markers

The Challenges

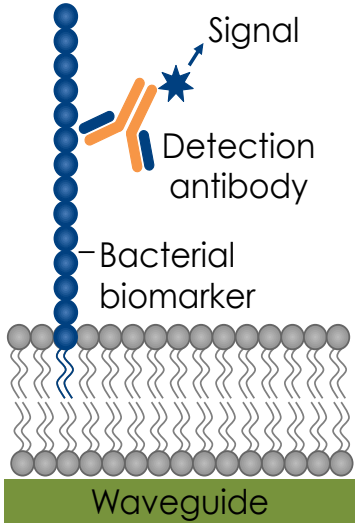
- Remote settings
- Lack of resources
- Time to diagnosis
- Sample (blood) needs to be processed before sensor can detect biomarkers

The Solution

1
drop of blood applied to assay cartridge



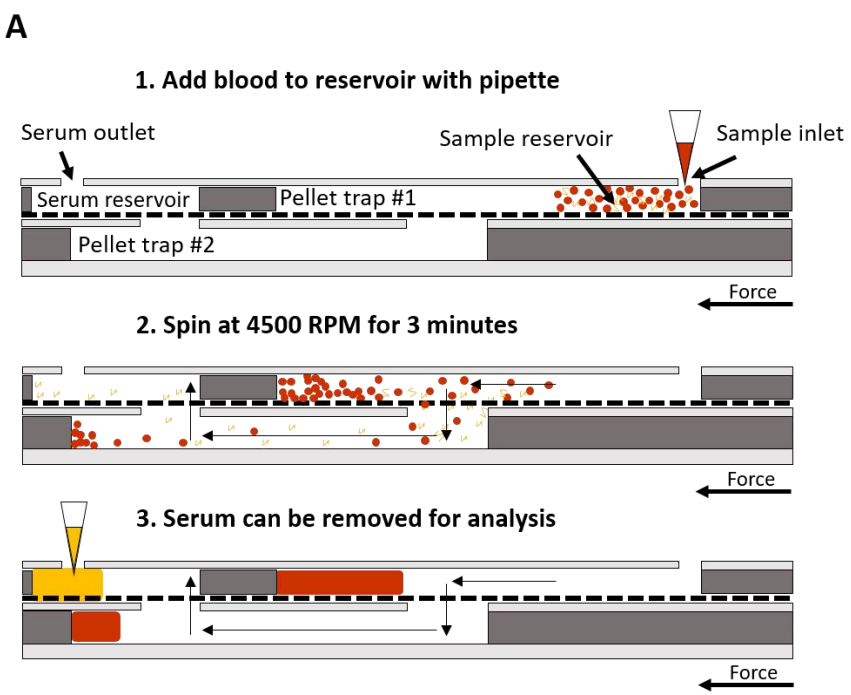
2
bacterial assay performed

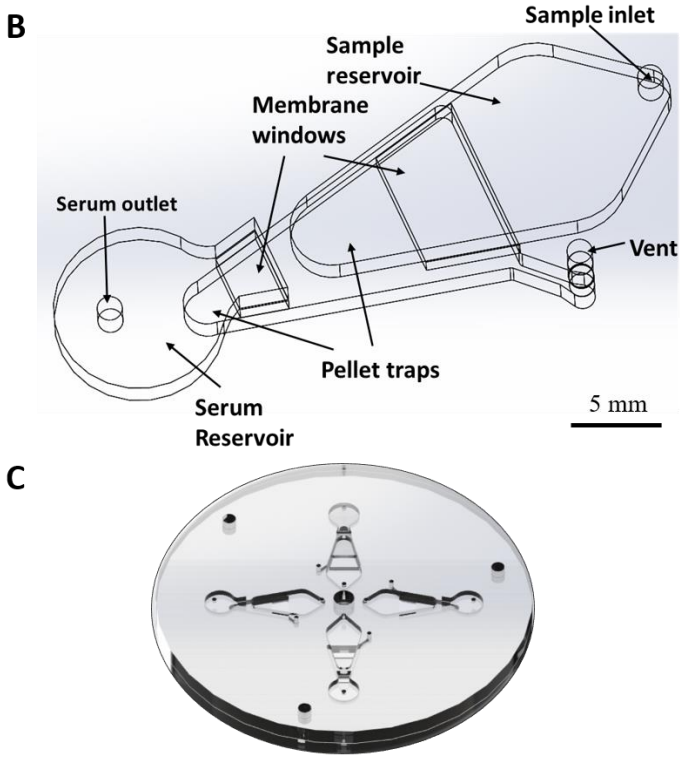


3
measurement taken in sensor

4
infection result

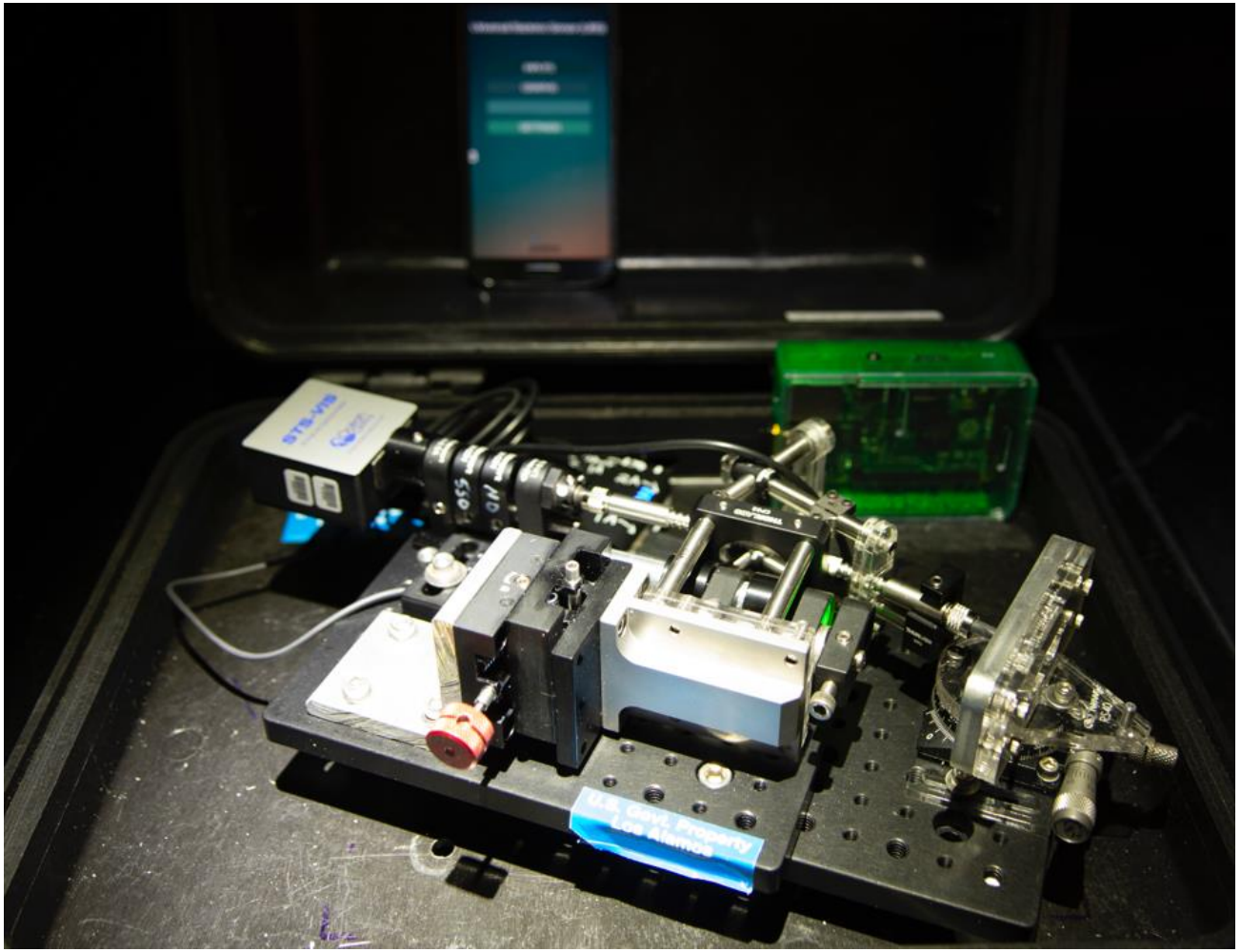
The Solution





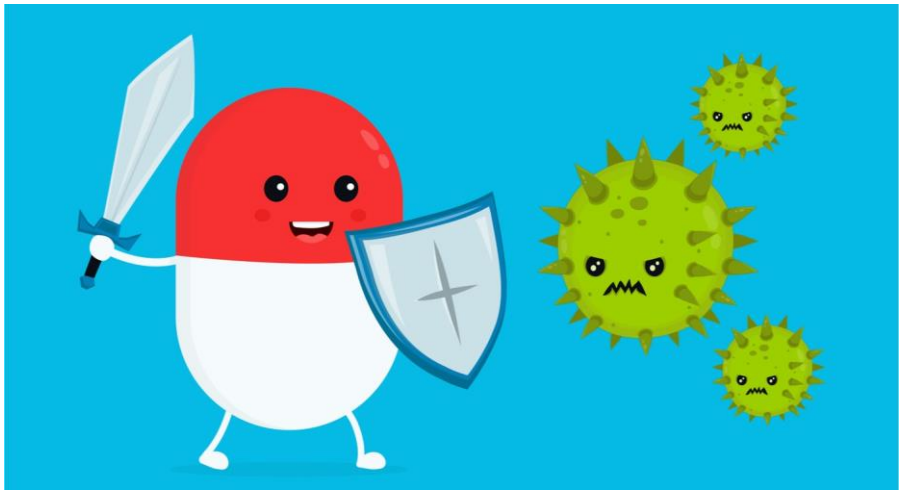
- Separation of serum from blood on microfluidic chip
  - Automated sample processing
  - Low volume requirements
  - No laboratory expertise needed

The Solution



The Outcome

- Diagnosis from a single sample type – blood
- Early diagnosis
  - guides treatment decisions
  - monitors prognosis
- Human and veterinary applications
- Distinguish between bacterial and viral infections
  - Very important for prescription decisions
  - Overuse/misuse of antibiotics can lead to antibiotic resistance!



Takeaways

- In the field of biomedical research, being *adaptable* is one of the greatest skills to have

- Being involved on multiple projects typically requires the learning of new skills
  - Literature review
  - Practice experiments
  - Consulting with experts

Questions 

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